Claim 14 (Previously Presented): The apparatus of claim 13, wherein the wick is a wire net.

Claims 15 and 16 (Canceled).

Claim 17 (Currently Amended): The apparatus of claim [[16]] 1, wherein a pump for pumping the coolant from the coolant supply source is installed on the circulation line.

Claim 18 (Canceled).

Claim 19 (Previously Presented): The apparatus of claim 1, further comprising a power supply, disposed outside the chamber, for supplying a power to the heating member, the heating member being connected to the power supply via lead lines;

wherein the substrate is processed by using a processing gas supplied into the processing chamber, and the sealing member prevents the lead lines from contacting with the processing gas.

Claim 20 (Canceled).

REMARKS

Favorable reconsideration of this application, in view of the present amendment and in light of the following discussion, is respectfully requested.

Claims 1, 2, 4-10, 12-14, 17, and 19 are currently pending, with Claims 6-10 being withdrawn from consideration as directed to a non-elected invention. In the present amendment, Claims 1, 13, and 17 are currently amended and Claims 15, 16, and 20 are canceled without prejudice or disclaimer. Support for the present amendment can be found in the original specification, for example, at page 12, lines 8-17, at page 19, lines 7-24 and in Figures 4 and 7. Thus, it is respectfully submitted that no new matter is added.

In the outstanding Office Action, Claims 1, 2, 4, 5, 12-17, 19, and 20 were rejected under 35 U.S.C. § 112, second paragraph; Claims 1, 2, 4, 12, 15, 19, and 20 were rejected under 35 U.S.C. § 103(a) as unpatentable over Ryusuke et al. (Japanese Patent Publication No. 05-009740, hereinafter "Ryusuke") in view of Kobayashi et al. (U.S. Patent No. 5,470,451, hereinafter "Kobayashi"), Grosshart (U.S. Patent No. 5,948,283), Anderson (U.S. Statutory Invention Registration No. H1145), Kim (U.S. Patent No. 5,983,998), and Kazama et al. (U.S. Patent No. 5,567,267, hereinafter "Kazama"); Claim 5 was rejected under 35 U.S.C. § 103(a) as unpatentable over Ryusuke in view of Kobayashi, Grosshart, Anderson, Kim, and Kazama, and further in view of Otsuki (U.S. Publication No. 2001/0003271); Claims 16 and 17 were rejected under 35 U.S.C. § 103(a) as unpatentable over Ryusuke in view of Kobayashi, Grosshart, Anderson, Kim, and Kazama, and further in view of Burger et al. (U.S. Patent No. 4,143,523, hereinafter "Burger"); Claim 13 was rejected under 35 U.S.C. § 103(a) as unpatentable over Ryusuke in view of Kobayashi, Grosshart, Anderson, Kim, and Kazama, further in view of Byrd (U.S. Patent No. 3,537,515); and Claim 14 was rejected under 35 U.S.C. § 103(a) as unpatentable over Ryusuke in view of Kobayashi, Grosshart,

Anderson, Kim, and Kazama, and further in view of Mundlinger et al. (U.S. Patent No. 5,453,641, hereinafter "Mundlinger").

Regarding the rejection of Claims 1, 2, 4, 5, 12-17, 19, and 20 under 35 U.S.C. § 112, second paragraph, it is noted that amended Claim 1 no longer recites the term "near." Accordingly, it is respectfully submitted that Claim 1, and all claims dependent thereon are definite. However, if the Examiner disagrees, the Examiner is invited to telephone the undersigned who will be happy to work with the Examiner in a joint effort to derive mutually acceptable language.

In response to the rejections under 35 U.S.C. § 103(a), Applicants respectfully request reconsideration of these rejections and traverse these rejections, as discussed below.

By way of review, the invention defined in amended claim 1 is a substrate processing apparatus which includes a sealing member disposed between a bottom of a support of a mounting table and a bottom portion of a processing chamber, a cooling unit, a temperature sensor, and a cooling unit controller. In particular, the cooling unit has a cooling medium for cooling the sealing member by using a latent heat of vaporization of the cooling medium included therein. Further, the cooling unit includes an airtight casing for accommodating the cooling medium therein, the casing having a first and a second end portion. The first end portion is disposed below the sealing member and is inserted into an opening formed through the bottom portion of the processing chamber. The second end portion is disposed outside the processing chamber. Also, the temperature sensor is inserted into an aperture formed through the bottom of the processing chamber, and is disposed between the sealing member and the first end portion. Furthermore, the cooling unit controller controls flow rates of a coolant based on a measurement result of the temperature sensor. Additionally, the cooling unit further includes a condenser accommodating therein the second end portion to thereby liquefy, in the second end portion, the cooling medium vaporized in the first end portion.

The condenser includes a vessel for accommodating therein the second end portion. Additionally, a circulation line for circulating the coolant which liquefies the vaporized cooling medium in the second end portion is connected to the vessel and a coolant supply source.

As shown in the exemplary embodiments of Figures 4 and 7, the substrate processing apparatus has openings formed at two or more places in the bottom portion of the chamber. An airtight casing is inserted into one opening, and a temperature sensor is inserted into the other opening. Further, a first end portion of the airtight casing is disposed below the sealing member in a perpendicular direction, and the second end portion thereof is disposed within a condenser disposed outside the chamber. Also, the temperature sensor is disposed between the sealing member and the first end portion, so that a cooling unit controller controls flow rates of a coolant which flows in the condenser based on a measurement result of the temperature sensor. The cooling medium, which is vaporized by absorbing heat in the first end portion, is transferred to the second end portion so as to be cooled down and liquefied by the condenser therein. The liquefied cooling medium is transferred to the first end portion again by the wick. Due to repetition of this cycle, the cooling unit controller controls flow rates of a coolant which flows in the condenser to thereby be capable of indirectly controlling temperature of the sealing member. In this connection, the first end portion of an airtight casing in which a coolant is circulating is inserted into an opening formed through the bottom portion of the processing chamber, and the second end portion of the airtight casing is disposed outside the processing chamber so as to indirectly cool down a sealing member. These features allow a film forming apparatus to be smaller and allow the sealing member to be cooled down.

It is respectfully submitted that the cited references do not disclose or suggest every feature recited in amended Claim 1.

Ryusuke is directed to a semiconductor wafer heating device. In particular, Ryusuke describes a heating apparatus including a thermocouple 21 that measures the temperature of the resistance heating unit.[1] As can be seen in Figure 8 of Ryusuke, the thermocouple 21 passes through the flange 15 and extends into the ceramic base body 3. The Office Action equates the thermocouple 21 described in Ryusuke to the claimed temperature sensor.

However, as can be seen in Figure 8 of Ryusuke, the thermocouple 21 is not disposed between the o-ring 12 and the cooling jacket 16. Further, the Office Action concedes on page 4 that Ryusuke does not teach that "the temperature sensor insert into an aperture formed through the bottom portion of the processing chamber." Instead, the Office Action relies on Kobayashi to modify the semiconductor wafer heating device of Ryusuke to turn the orientation of the process chamber by 180° so that the o-ring 12 is between the case attaching ring 25 and a bottom portion of the processing chamber.[2] However, even assuming this modification is proper, the combination of Ryusuke as modified by Kobayashi does not teach the claimed positioning of the temperature sensor. Further, it is noted that Kobayashi does not disclose or suggest a cooling unit or a temperature sensor.

The Office Action relies on Grosshart to modify the above combination to replace the cooling jacket 16 with a refrigeration source outside the chamber.[3] Grosshart describes a thermocouple temperature sensor 80 in thermal contact with a lower electrode 16, and that water used as a coolant is circulated through the electrode 16, which contains an internal pathways configured to promote heat transfer between the electrode and the water.[4] Thus, the temperature sensor 80 of Grosshart measures a temperature of the lower electrode, and the water circulated through the electrode 16 does not correspond to the cooling medium being vaporized within the airtight casing. Additionally, it is respectfully submitted that Grosshart

[1] See Ryusuke, at paragraph [0005] and in Figure 8.
[2] See the Office Action in the fourth paragraph on page 5.
[3] See the Office Action in the first paragraph on page 6.
[4] See Grosshart, at column 6, lines 15-36 and in Figure 3.

does not cure the above-noted deficiencies of Ryusuke as modified by Kobayashi regarding the positioning of the temperature sensor.

The Office Action next relies on Anderson to modify the above-discussed references to include a refrigeration unit that utilizes the latent heat of vaporization to cool the wafer chuck.[5] Anderson describes a wafer chuck extracting heat to cool the wafer, which is different from a cooling unit for cooling down a sealing member disposed in the bottom portion of a processing chamber.[6] Further, Anderson describes that a spray mechanism 22 sprays liquid supplied from a pressurized liquid source to a cavity of the chuck to vaporize the liquid to gas, and then, the gas is exhausted through an exhaust opening.[7] Thus Anderson does not describe that the first end portion of an airtight casing in which a coolant is circulating is inserted into an opening formed through the bottom portion of the processing chamber, and the second end portion of the airtight casing is disposed outside the processing chamber so as to indirectly cool down a sealing member. Accordingly, the installed spaces become larger in the case of combing the spray mechanism 22 of Anderson with the modified bottom portion of the processing chamber of Ryusuke. Additionally, it is respectfully submitted that Anderson does not cure the above-noted deficiencies of Ryusuke as modified by Kobayashi and Grosshart regarding the positioning of the temperature sensor.

The Office Action relies on Kim to modify the cooling jacket 16 described in Ryusuke with a cooling unit including first and second end portions and a condenser.[8] Kim relates to an ordinary air conditioner using refrigeration sources. Since the technical background of the air conditioner described in Kim is completely different from that of the cited references, it would not be obvious to a person of ordinary skill in the art to combine the system of Kim with the other cited references. Additionally, even assuming such a

[5] See the Office Action in the second and third paragraphs on page 6.
[6] See Anderson, at column 4, line 52 to column 5, line 3 and in Figure 2.
[7] See Anderson, at column 5, lines 4-20 and in Figure 2.
[8] See the Office Action in the fourth and fifth paragraphs on page 6 and the first paragraph of page 7.

combination is proper, it is respectfully submitted that Kim does not cure the above-noted deficiencies of Ryusuke as modified by Kobayashi, Grosshart, and Anderson regarding the positioning of the temperature sensor.

Finally, regarding Claim 1, the Office Action relies on Kazama to modify the above-cited references to use the cooling control system described in Kazama.[9] Kazama describes a temperature measurement resistor 21 measuring temperature of a susceptor 4a which is not disposed between a sealing member and a first end portion of a casing of a cooling unit.[10] Also temperature sensors 31a described in Kazama are only liquid level detecting means, and not based on feedback control to cool down the sealing member.[11] Accordingly, it is respectfully submitted that Kazama does not cure the above-noted deficiencies of Ryusuke as modified by Kobayashi, Grosshart, Anderson, and Kim at least regarding the positioning of the temperature sensor.

Accordingly, in view of the above discussion, it is respectfully submitted that none of the cited references, either alone or in combination, disclose or suggest that the temperature sensor is disposed between the sealing member and the first end portion. Further, it is respectfully submitted that the references do not disclose or suggest that a condenser and a second end portion is disposed outside the chamber, and that only a part of the airtight casing is inserted into the bottom portion of the processing chamber to diminish the installed spaces.

Accordingly, it is respectfully submitted that the combination of Ryusuke as modified by Kobayashi, Grosshart, Anderson, Kim, and Kazama does not disclose or suggest every feature recited in the amended Claim 1. Thus, it is respectfully requested that the rejection of Claim 1, and all claims dependent thereon, be withdrawn.

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[9] See the Office Action in the second and third paragraphs on page 7.
[10] See Kazama, at column 5, lines 20-23 and in Figure 1.
[11] See Kazama, at column 6, lines 29-40.

Regarding the rejections of Claims 5, 13, 14, 16, and 17, it is noted that Claim 16 is hereby cancelled. Further, it is respectfully submitted that none of the remaining secondary references (Otsuki, Burger, Byrd, and Mundlinger) cure the above-noted deficiencies of Ryusuke as modified by Kobayashi, Grosshart, Anderson, Kim, and Kazama. Accordingly, it is respectfully requested that the rejections of Claims 5, 13, 14, 16, and 17 also be withdrawn.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. A Notice of Allowance is earnestly solicited.

Respectfully submitted,

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